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AN ANALYSIS OF RAPID TECHNOLOGY TRANSFER SOLUTIONS AND BEST PRACTICES FOR USE BY THE DEPARTMENT OF DEFENSE

by

Dennis R. Holden

December 2010

Thesis Advisor:	Dennis Volpano
Second Reader:	Susan Higgins

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The DoD is burdened by an Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System that is designed to acquire large systems, such as ships, and that takes years to complete. Information technology evolves at a rapid pace because it is driven by industry. The DoD acquisition system is therefore at odds with industry development, at least with respect to information technology. Acquisition of information technology cannot follow the same path as a ship if the DoD wants the warfighter to have the most advanced technologies.
The acquisition of technology is about much more than the technology alone. Each stage of the acquisition process, even for technologies that are never ultimately adopted, offers some information that needs to be cataloged in a way that others can use it. This thesis proposes a clearinghouse for this purpose. The clearinghouse should decrease the amount of time required to get information technology to the warfighter. The changes that need to occur are not limited to information sharing. Although that is a central component, this thesis identifies other barriers that must be overcome.

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AN ANALYSIS OF RAPID TECHNOLOGY TRANSFER SOLUTIONS AND BEST PRACTICES FOR USE BY THE DEPARTMENT OF DEFENSE

Dennis R. Holden
Lieutenant Commander, United States Navy
B.S., United States Naval Academy, 2001

Submitted in partial fulfillment of the
requirements for the degree of

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NAVAL POSTGRADUATE SCHOOL
December 2010

Author: Dennis R. Holden

Approved by: Dennis Volpano
Thesis Advisor

Susan Higgins
Second Reader

Peter J. Denning
Chairman, Department of Computer Science

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ABSTRACT

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LIST OF ACRONYMS AND ABBREVIATIONS

ACAT	Acquisition Category
AoA	Analysis of Alternatives
CAC	Common Access Card
CAPE	Cost Assessment and Program Evaluation
CCDR	Contractor Cost and Data Reporting
CCR	Central Contractor Registration
CIO	Chief Information Officer
CNSS	Committee on National Security Systems
COTS	Commercial Off-the-shelf
CPARS	Contractor Performance Assessment Reporting System
CRC	Capabilities Requirements Clearinghouse
CSD	Computer Security Division
CSDR	Cost and Software Data Reporting
DAA	Designated Approving Authority
DADMS	Department of Navy Application and Database Management System
DFARS	Defense Federal Acquisition Regulations System
DIACAP	Department of Defense Information Assurance Certification and Accreditation Process
DITPR	DoD Information Technology Portfolio Registry
DoD	Department of Defense
DoN	Department of the Navy
DTIC	Defense Technical Information Center
EO	Executive Order
ESI	Enterprise Software Initiative
FAR	Federal Acquisition Regulation
FBO	Federal Business Opportunities
FISMA	Federal Information Security Management Act
FPDS-NG	Federal Procurement Data System-Next Generation
FTP	File Transfer Protocols

GOTS	Government Off-the-shelf
GPS	Global Positioning System
GSA	General Services Administration
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
IA	Information Assurance
IAE	Integrated Acquisition Environment
IASE	Information Assurance Support Environment
IT	Information Technology
JCIDS	Joint Capabilities Integration and Development System
JITC	Joint Interoperability Test Command
JROC	Joint Requirements Oversight Council
MARCORSYSCOM	Marine Corps Systems Command
MDAP	Major Defense Acquisition Program
MIPR	Military Interdepartmental Purchase Request
NDAA	National Defense Authorization Act
NII/CIO	Networks and Information Integration/Chief Information Officer
NIST	National Institute of Standards and Technology
NSA	National Security Agency
O&M	Operation and Maintenance
ODR	Operational Deficiency Report
PKI	Public Key Infrastructure
POC	Point of Contact
POM	Program Objective Memorandum
PPI	Past Performance Information
QDR	*Quadrennial Defense Review*
R&D	Research and Development
RDT&E	Research, Development, Test, and Evaluation
REIT	Rapidly Evolving Information Technologies
SBIR	Small Business Initiative
SML	Statistical Machine Language

SMTP	Simple Mail Transfer Protocol
TRL	Technology Readiness Level
USMC	United States Marine Corps

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I. INTRODUCTION

A. KEEPING PACE WITH INFORMATION TECHNOLOGY WITHIN THE DOD

It is recognized by the DoD, the Defense Science Board, Congress, the Government Accounting Office, and, most importantly, by the warfighters themselves that the current Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System needs overhauling, specifically for acquiring rapidly evolving information technology systems (Defense Science Board [DSB], 2009; Government Accountability Office [GAO], 2008, 2009a, 2009b, 2010). Acquisition in the DoD spans a wide range of technologies and readiness levels, called technology readiness levels (TRLs). For a deeper understanding of TRLs, see Appendix A. Among the highest readiness levels are weapons systems, communications, and information technology (IT). Some technologies are developed specifically for military use and others are commercial technologies adapted for military use. Communications and IT are two areas that borrow extensively from the commercial world. With private funding behind them, they tend to evolve rapidly, presenting a serious challenge to DoD acquisition. While adversaries can adopt these technologies quickly through online resources and web stores, the DoD has to follow a process that, in many ways, is the same process used for acquiring large-scale systems. As Deputy Defense Secretary William J. Lynn III pointed out, the process has not been efficient:

> The U.S. military is the most capable armed force in the world, in part, because of the edge given by the reliance on information technology, but the procurement process for software and hardware still is mired in the industrial age, tied to the way the department buys tanks or ships or aircraft. In this very ordered process, we decide what the mission is, identify the requirements that are needed to meet that mission and analyze alternatives to meet those requirements, eight or nine years later, we actually have something. (Garamone, 2010)

Currently, the DoD acquires technology through the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. This system is overwhelming in bureaucracy, in time, and in complexity. Appendix B contains a current pictorial roadmap of the entire Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. Figure 1 shows an overview of this process.

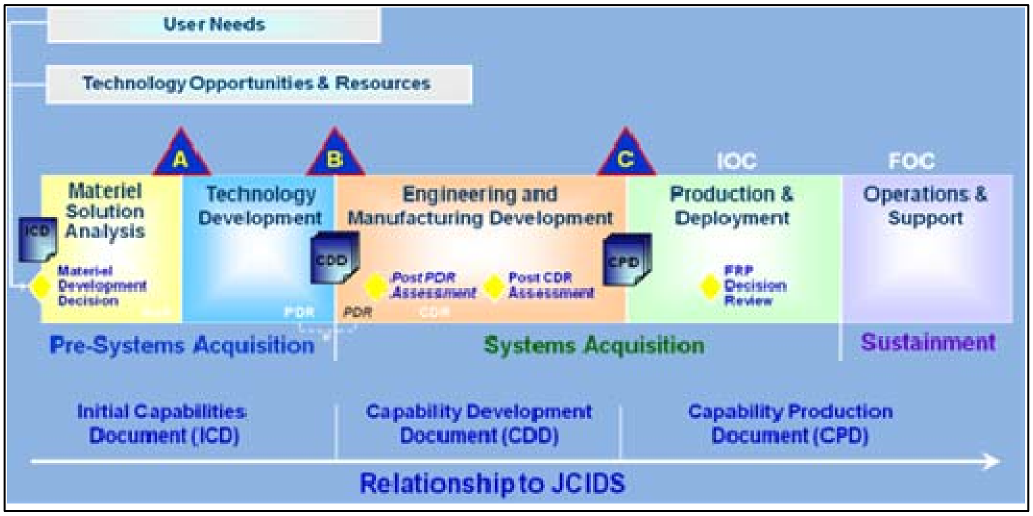

Figure 1. Snapshot of Defense Acquisitions Life Cycle Management System (from Murphy, 2010)

The Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System is comprised of three key processes that must work together to deliver products to the warfighter:

- The requirements process (Joint Capabilities Integration & Development System, JCIDS),
- The acquisition process (Defense Acquisition System), and
- The program and budget development process (Planning, Programming, Budgeting, and Execution, PPBE).

Each of these processes is governed by policies from multiple DoD documents. Furthermore, under DoD Instruction 5000.02, the acquisition process is broken up into phases that are divided by major decision points called *milestones*. In Figure 1, the milestones are represented by triangles with letters inside. Because each acquisition is

unique, the acquisition system allows DoD acquisition professionals to tailor the number of phases and decision points inherent in each program. The individual tailoring available is graphically shown in Appendix B.

To further complicate IT acquisition, organizations within the federal government have inserted many other hurdles into the process through either policy or law. One example is the Department of Defense Information Assurance Certification and Accreditation Process (DIACAP), a required process for all IT acquisitions. The process is complex and time-consuming in order to achieve and maintain the required authority to operate (ATO) a network. The DIACAP process requires interaction with National Institute of Standards and Technology (NIST) guidelines. The NIST is an agency responsible for developing information security guidelines under the Federal Information Security Management Act (FISMA); these guidelines can be accessed on the NIST's website (http://csrc.nist.gov). Two NIST special publications were released in May 2010 in order to provide more clarity and to streamline the Information Assurance Certification and Accreditation (IA C&A) process by including the following documents: (1) *Recommended Security Controls for Federal Information Systems and Organizations*, which provides a common risk management strategy for federal security (National Institute of Standards and Technology [NIST], 2009); and (2) *Guide for Assessing the Security Controls in Federal Information Systems and Organizations*, which provides updated assessment techniques and procedures (NIST, 2010). These documents are considered positive steps forward because they are current and reflect known issues and time concerns faced by DoD acquisition professionals during the IA C&A process. The documents also provide standards on which the industry can build their products and that will then speed up the IA C&A process. Despite attempts such as these to streamline the DIACAP process, it remains woefully cumbersome.

The National Defense Authorization Act (NDAA) for Fiscal Year 2004 (2003) is aimed at overcoming these burdens when the need is life-threatening and urgent (e.g., reinforcing the armor on all-terrain vehicles). IT acquisition normally does not qualify

for urgent classification; instead, it is governed by the rules and regulations outlined in the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System.

For commercial information technology that evolves quickly, a more nimble and efficient acquisition process is needed. This technology will be referred to in this thesis as “Rapidly Evolving Information Technology” (REIT). REIT is commercial technology that evolves quickly and is typically information technology with a readiness level of six or greater. It demands a more nimble and efficient acquisition process. The DoD is no longer the single driving force behind advanced technology acquisition and development. Consumer demand is largely driving the evolution of REIT. The DoD’s acquisition strategy for such technology is not well suited for this shift to consumer demand driving acquisition and needs to evolve. However, the process needs to evolve much more rapidly than it has in the past.

1. A Call to Arms

IT acquisition reform within the DoD and federal government is an ongoing effort. For decades, laws and policies have been changed by both the federal government and the DoD. The DoD has attempted to improve its Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. The Packard Commission of 1986, the Clinger–Cohen Act of 1996, the National Defense Authorization Acts, and the Defense Science Board reports are just a few examples of major attempts to improve the system (Christensen, Searle, & Vickery, 1999; DSB, 2009; NDAA for Fiscal Year 1996, 1996; Ronald W. Reagan NDAA for Fiscal Year 2005, 2004). Problems with cost, schedule, and performance recur each decade as the DoD’s needs continue to exceed its resources and abilities. The federal government continues to make noble efforts to improve the process of the overall system, but improving the acquisition of REIT needs additional effort. There is no single, efficient, and rapid solution for acquiring every software application or new piece of network hardware. In many cases, REIT advances faster than new laws and policies can be put in place to acquire it. In addition to policy, people and technology are important to help speed up the Integrated Defense Acquisition,

Technology, and Logistics Life Cycle Management System. Rarely do improvements to just one process, policy, person, or technology revise the overall situation. A holistic approach is needed.

On October 28, 2009, the NDAA for Fiscal Year 2010 directed the Secretary of Defense to develop and implement a new acquisition process for IT systems. The law also directed the new acquisition process to include the findings of the March 2009 report authored by the Defense Science Board Task Force and titled *DoD Policies and Procedures for the Acquisition of Information Technology* (NDAA, 2009). In February 2010, the Secretary of Defense signed the DoD *Quadrennial Defense Review (QDR)*, which clearly articulated the DoD adherence to the NDAA for Fiscal Year 2010 under the Reforming How We Do Business section. Specifically, the *QDR* discusses broad topics, such as reforming how we buy, institutionalizing the rapid acquisition capability, and strengthening the industrial base. In addition to the QDR, the NDAA for fiscal year 2010 established Task Force 804 to provide feedback to Congress within 270 days (Lenat & Rode, n.d.).

2. "Going Embedded" During Research

To gain a new perspective on the problem, I embedded inside an assortment of system commands over a period of twelve months. Among others, these commands included MARCORSYSCOM. Each of the commands provided me with a view of how information technology is acquired on the front lines. Each command had improved the acquisition process in some manner, yet those improvements were not normally practiced by the other commands. Collectively, their processes began to shape a new process that adapted to a rapidly changing information technology landscape. What emerged was a process that has been dubbed "Collective Acquisition." This Collective Acquisition process is characterized by an openness of the commands to leverage their efforts when it comes to acquisition. For instance, if a command understands where the potential cryptographic weaknesses are in getting a product such as a personal digital assistant from one vendor certified by the NSA (National Security Agency) for classified use, then this could be shared with another command and perhaps reduce the time to certify a

different product from the same vendor. However, there are many obstacles in the way of making Collective Acquisition a reality. Some are technical, but others are cultural. Each of these obstacles is discussed in Chapter IV.

3. Thesis Outline

The remainder of this thesis outlines a framework for acquiring rapidly evolving technology, or for Collective Acquisition. Chapter II contains an overview of the framework for Collective Acquisition and provides an example of acquiring information technology. The backbone of this framework is a new type of information exchange that will be referred to as the *Capabilities and Requirements Clearinghouse* (CRC). It is much more than a data repository and is described in detail in Chapter III. Chapter IV looks at barriers to adopting the new framework. Finally, Chapter V addresses its execution—steps that could be taken to put the framework into practice.

II. COLLECTIVE ACQUISITION

A. A MOTIVATING EXAMPLE

The term *Collective Acquisition* was chosen to highlight its collaborative nature, which is key to providing the agility necessary to acquire technologies that evolve very rapidly. These technologies tend to be information technologies and fall into an acquisition category (ACAT) three classification. No longer should stakeholders operate in isolation. Over time, their work should be leveraged across the DoD and other agencies.

An example will help to illustrate the framework for acquiring rapidly evolving technology. Suppose two vendors, X and Y, have delivered military solutions, perhaps at different times. Each has delivered a system comprised of vendor components under various contracts and has had systems certified according to the Joint Interoperability Test Command (JITC) standards. These contracts, certifications, costs, etc., are artifacts of an acquisition that can be reused. Therefore, Collective Acquisition comprises an information clearinghouse called *Capabilities and Requirements Clearinghouse* (CRC). The CRC is populated with information about X's and Y's previous deliverables. This is the *capabilities* part of the clearinghouse.

Suppose a military ground unit wants to deploy a new technology to the field for biometrically binding users to cellular phones through speaker recognition, making it so that calls placed to a person reach that person no matter which phone they are using. After all, cell phones are low-cost alternatives to Joint Tactical Radio Systems (JTRS). Cell phones can be lost or stolen, or their batteries can fail. Tracking phone numbers is not feasible. This new technology will be referred to in this thesis as "SPKRCELL."

As a user speaks, SPKRCELL recognizes the user's voice and then associates the user's identity with that phone. If the user speaks into another phone, then he or she will become identified with that phone instead. To call a person, a user only needs to refer to

the person by name because the person's name is mapped to a phone number by SPKRCELL using a name resolution function like the Domain Name System.

Within the Collective Acquisition framework, the need for SPKRCELL is communicated initially as is done today through identifying a capability gap, such as through an Operational Deficiency Report (ODR). The ground unit would complete a standard, one-page ODR. Appendix A contains a copy of the ODR used today. The following is an overview of the information required in the report:

- The operational requirement (who, what, where, when, why, how),
- The capability required,
- The operational deficiency, and
- The solution to be employed.

The form begins and is maintained as a digital document, which is submitted online or through e-mail to the requirements branch of the ground unit's parent command. These reports, though governed by the JCIDS process at a high level, may be processed or handled differently at lower levels. For instance, they may be disseminated by e-mail in some cases (pushed to users) or uploaded to a website in others (pulled by users). Collective Acquisition proposes to standardize how they are handled by storing them in the CRC, affording uniform access to them across the DoD. The CRC acts as a single access point to combine information, people, and processes from the entire command. From the CRC, all future stakeholders in the process have the ability to add and edit comments, approve content, and validate the report. The CRC might also offer configurable alerts by the requirements branch so that stakeholders can be notified of the need for SPKRCELL technology and its timeline via e-mail, voice mail, text messages, etc. Within minutes, key stakeholders in the command could be notified of the new requirement from the ground unit, leading to faster validation (invalidation) of the report.

Ultimately, the ODR for the SPKRCELL requirement will be validated or invalidated. Either way, there is information that needs to be cataloged. For instance, it is extremely important to know whether the SPKRCELL ODR was not validated because a stakeholder like the NSA identified a security vulnerability or whether it was not

validated by default because the deadline for comment expired. This information is stored along with the ODR in the CRC. If a similar requirement emerges in the future, then it will be much clearer how to proceed with the history of the SPKRCELL ODR available.

Consider a scenario in which the SPKRCELL ODR is validated and it is not urgent (if urgent, a different path needs to be taken). The CRC lifts the ODR's visibility to an approval level. Warfighters and personnel at the requirements, acquisition, and budget branches all have access to the SPKRCELL ODR. This access takes place at a local command level or higher. It allows enterprise-level planners to see if the requirement matches other requirements at higher levels, such as across the entire DoD enterprise.

The CRC has a powerful search feature capable of matching against very unstructured data—for example, images and audio recordings. The CRC searches for artifacts such as operational deficiency reports and documented capabilities related to SPKRCELL ODR. The search may even occur autonomously after the CRC is updated with the SPKRCELL ODR. Suppose the search reveals that vendor X once delivered a system with a speaker recognition component, and vendor Y delivered a name resolution system for personal names. At this stage, an acquisition professional might wish to pursue integrating these components to meet the SPKRCELL ODR. This person would further query the CRC for integrator options. Some acquisition professionals do not have the appropriate expertise, and the integrator options would be information provided by the CRC. For the sake of this example, suppose integrator Z appears to be a good candidate. The CRC provides contact information for all the parties involved. At this point, each would be engaged to explore the feasibility of jointly meeting the ODR within suggested budget constraints.

Suppose X, Y, and Z have come up with a cost estimate that is within budget. The Collective Acquisition framework would support budget management through a software package like Quicken® (http://www.quicken.com)—in this thesis it will be referred to as "QuickenGov." A budget expert would launch QuickenGov to find funding

for X, Y, and Z. QuickenGov would replace complex Excel® spreadsheets and provide a better user interface, like those sold commercially for use as personal finance programs. It would also provide another very useful feature: QuickenGov would have the ability to be programmed to discover opportunities for re-allocation of funding based on success and failure criteria and on the overall status of other programs. For instance, if a program failed to execute to a specific milestone by a certain time, then DoD leadership and acquisition professionals would like to know this fact because it presents a potential source of funds. Suppose SPKRCELL hits the Program Objective Memorandum (POM) process in an off year and, therefore, does not have funding. In this case, this discovery feature would need to be exploited to find funding from another program. Further, suppose we discover in these reports three programs of record that are not executing their funding in the current quarter and are identified as high risk for failure based on their status reports. In order to provide for the new requirement for SPKRCELL in the current quarter, the budget expert re-allocates funding from the failing programs into a new program for SPKRCELL under integrator Z, who has been contracted to combine vendor X's and Y's components into a system that meets the SPKRCELL ODR. The Collective Acquisition framework provides better visibility into budget and suggests ways it can be re-allocated if necessary. Of course, the command in question must have the authority to re-allocate funding within the current fiscal year.

The next step in the Collective Acquisition framework would be to develop and execute a test and evaluation plan. The contractual plan would be a combination of input from the acquisition professional and integrator Z. The plan would include milestones as well as delivery schedules and baseline requirements to meet at each milestone (e.g., Beta version).

The acquisition professional would use his or her experience and knowledge as well as the CRC to coordinate what he or she expects to be done during the test and evaluation of integrator Z's implementation of SPKRCELL. The CRC would provide a knowledge base for lessons learned and examples of acquisition programs that have been completed. The CRC could be queried to discover similar information technology

systems in the DoD, which could then be leveraged to avoid starting acquisition programs from scratch. Suppose in our example that the acquisition professional conducts a search for programs similar to SPKRCELL based on the ODR. The CRC would be populated with NIST special publications, as mentioned in Chapter I. As such, the CRC could detect special IA C&A testing that needs to be done that perhaps integrator Z did not foresee. The acquisition professional would be aided by the CRC because it would be working in the background to notify organizations that might have interest in a new technology. In the case of the SPKRCELL program, the CRC would alert the NSA after SPKRCELL was approved because it contained references to speaker recognition and cellular technology. As a result, the NSA would have been given the opportunity to view information about the vendors chosen to implement and test SPKRCELL. Therefore, the NSA could have proactively contacted the acquisition professional in charge of the SPKRCELL program to work with them through the IA C&A process.

As part of the Collective Acquisition framework for IA C&A and for test and evaluation, the acquisition professional would require integrator Z to use a testing system available today called the *IA test range*. The IA test range is a system approved by the Designated Approval Authority (DAA) that provides a risk-free environment for integrator Z to quickly assess IA compliance and meet the requirements of the acquisition professional (mandated by Chairman of the Joint Chiefs of Staff Instruction [CJCSI] 3170.01 and CJCSI 6212.01) as if they were on the operational network (Chairman of the Joint Chiefs of Staff [CJCS], 2008, 2009). The concept of the IA test range replicates an operational physical or cellular network using packet generation, virtual machines, and other tools to mimic bandwidth constraints and software programs. An important extension of the test range is its ability to interface with the CRC in two directions. First, results of a test can be entered into the CRC, and, second, test configurations can be loaded from the CRC into the IA test range.

For instance, suppose in our example that the acquisition professional has discovered that the NSA is concerned about speaker recognition being vulnerable to man-in-the-middle (MITM) attacks. The professional could tailor an MITM threat

configuration for the IA test range and load it directly from the CRC into the test range. The CRC, in turn, would be updated directly with the results of the test against the MITM threat.

The Collective Acquisition framework comprises powerful search techniques found in the CRC. But the framework is not limited to just the CRC. It includes new practices such as key interactions between stakeholders at various stages. These interactions are as important to acquisition as the CRC itself.

III. CAPABILITIES AND REQUIREMENTS CLEARINGHOUSE

The CRC is new technology—pieces of which exist in various forms today—and is a new system that the DoD should use as a way of significantly improving the acquisition of REIT. Some commercial software programs are in use by the DoD that help the matching of requirements to capabilities during the acquisition process. IBM's Rational RequisitePro™ is one example of a requirements management tool with the ability to trace requirements to capabilities (http://www-01.ibm.com/software/awdtools/reqpro/). The CRC will accomplish more than the IBM RequisitePro because the CRC will be done through logistics life cycle management and through transparent methods of sharing and analyzing information. The system will streamline the market research and analysis of alternatives process through better use of information, knowledge, people, processes, and technology. The goal of the CRC is to accomplish what Bloomberg, E-Trade, and other companies have done in providing in-depth information and analysis to financial companies, bankers, traders, and individual consumers. The CRC will provide similar information, but its audience will be the stakeholders to the acquisition process, including the end user.

Initial market research and an analysis of alternatives are important steps for cutting down the time it takes to process acquisitions through the identification of proper material solutions. Products with a TRL of six or greater that are matched to requirements significantly decrease the amount of time the acquisition process takes compared to low TRLs. The current practices used in market research and in an analysis of alternatives involve studies (independently paid for through contractors), online search engines, other online resources such as those listed in Appendix D, and individuals who have a network of personnel and resources to lean on in order to find information. All of these efforts require the person entering the requirement to make an extra effort to find what he or she is looking for or to make the determination to buy the technology or to

develop it. The CRC would decrease the amount of time required for market research and for an analysis of alternatives as well as provide better information than what normally would be found scattered between a multitude of resources.

A. HOW DOES IT WORK?

In order to accomplish these goals, the CRC would need to be a central repository or gateway to information used for the collection, dissemination, and transfer of information between federal systems and private industry. Interoperability is key to the success of the CRC; the more information it can leverage online—by legacy or through private industry—the better it will be. The power of the CRC will be in bringing together all of the information available and in directing the right information to the acquisition professional before it is needed or in demand.

There are many online resources providing information to the acquisition community, but many of these resources do not exchange information (see Appendix D). The CRC would act as third-party software capable of pushing and pulling information between online resources (see Figure 2) while maintaining the security of the information and protecting that information in accordance with laws regarding who can see privileged information. The CRC would require all current and future resources to be interoperable (provide hooks) through protocol standards that would encourage the sharing of information. The information accessible through the online sharing of resources within the CRC would make up the backbone of dynamically changing information. To prevent duplication, the CRC would have the ability to search, push, and pull information from these online resources, but not necessarily to require it to store information on its own system (which would duplicate online resources). In order to add legitimacy and to ensure the use of the CRC, it will be necessary to incorporate into the system all of the legacy information that the DoD has until everything is available online. Within the DoD, many efforts have been completed to digitize the large number of documents necessary to complete an acquisition. These digitized and searchable documents would further add to the information the CRC could leverage.

The federal government and the DoD are working to maximize the potential offered by software and the Internet in order to improve the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. Online initiatives required by federal law and DoD policy have populated the Internet with multiple online resources related to acquisitions. The CRC would need to utilize the existing online resources in order to be a truly dynamic and useful tool in the acquisition system.

Some of the online acquisition initiatives are focused on specific areas of interest, such as information assurance. Other initiatives are focused on supplying multiple features, such as contractor registration and performance evaluations. The different online resources all have one goal in common: to provide better services to the user in order to help streamline the acquisition process. However, the online resources overlap in some cases and most of the time do not dynamically share their information with each other. Furthermore, since there are so many websites, it is difficult for users to remember all of the information available and to search each one, creating inefficiency in the acquisition process.

A serious effort should be made to dynamically share the information between the online resources and to standardize protocols in order to make the transfer of data between them seamless. A consolidation effort should also take place to decrease the number of individual online resources; there should be fewer interconnected resources, and there should be a third-party system that relates the sites, such as the CRC. The dynamic sharing of information across the online resources could be accomplished with the CRC acting as a third-party application.

One approach to consolidating the online resources available is by accessing them through a single website. The Integrated Acquisition Environment (IAE) website, sponsored by the E-Gov Initiative, states that it “provides one Web site for all things acquisition” (https://www.acquisition.gov/index.asp). This website does not include everything related to acquisition, but it makes a great effort to advertise online resources and tools available to the government and industry. The goal of the website is to simplify

and streamline the federal acquisition process for government and industry by providing more efficient and transparent practices through links to online resources. It is refreshing to see that there is an organization dedicated to improving the online efforts of the acquisition community, but more can be done to open up the online resources to each other and to leverage collective power. The CRC could act as this force multiplier by utilizing these resources collectively (see Figure 2). The IAE is a noble effort to bring online links to one website, but it does not provide the relationships between the resources that need to exist in order to leverage the resources of the federal government and to streamline the acquisition system.

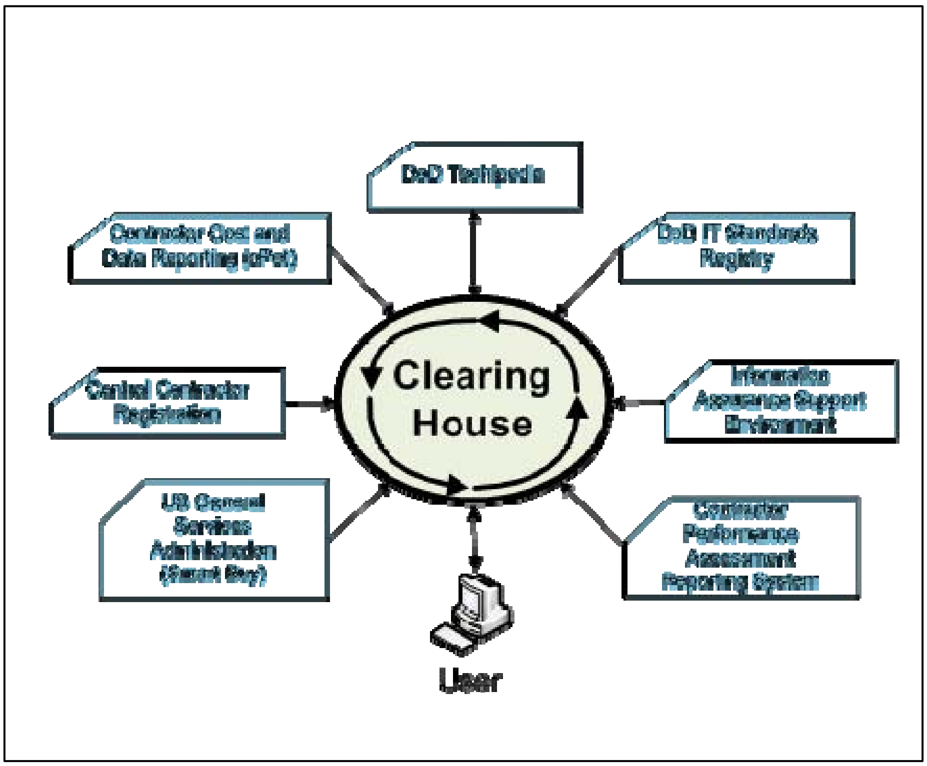

Figure 2. Sample online resource relational model

1. Stakeholders

In order to make the CRC relevant and useful for REIT, it should involve important stakeholders within the Integrated Defense Acquisition, Technology, and

Logistics Life Cycle Management System. The following is a list of the initial stakeholders:

- Requirements generators (operators);
- Private industry (Google, Cisco, BAE, small-business owners, etc.);
- Government research labs and institutions (Federal Laboratory Consortium);
- Acquisition professionals;
- Budget professionals;
- IA organizations and policy-makers (NSA, NIST); and
- Interoperability organizations (Defense Technical Information Center, DTIC).

The stakeholders listed are the most important decision-makers, individuals, and organizations that would benefit the most from the CRC. Furthermore, they would provide the most information and feedback for CRC adaptive learning. This is not an all-inclusive list; more should be added by DoD acquisition professionals as needed for CRC efficiency.

2. Incentivize Stakeholders

The CRC will only be a requirements and information depository, similar to DoD Techipedia and the Joint Requirements Oversight Council (JROC) online, unless the DoD can incentivize the stakeholders to enter past, present, and future capabilities into the CRC. In a memorandum from the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]) issued in 2001, the DoD attacked the incentive problem facing the acquisition industry. The usefulness of the CRC is defined by its ability to access other resources and legacy systems and, in general, to crawl through information. The CRC requires a well-defined incentive proposition for all of the stakeholders. Entering information could be accomplished in a similar fashion to the way information is entered into the classification system used for the capabilities documents of the DoD. For instance, most capabilities are associated with products that have brochures or product summaries. Using the intelligent system to classify these documents would help expedite the input of information into the CRC system.

Requirements generators would be the easiest group to incentivize because they would see returns on their input investment faster than before they used the CRC. It would be important to initially track and advertise the time spent from requirement input to product-in-hand and to report this information back to requirements generators and the chain of command in order to show the importance of the CRC and the value it provides (justification of funding).

In order to incentivize private industry, different approaches should be used by the DoD. Private industry would arguably be incentivized the most through increased profits. The CRC would provide industry with access to all requirements generated within the DoD. This access would allow industry to market their products to target audiences who would likely buy their products. Also, industry would make more money through this enterprise approach because organizations and departments within the DoD that would normally procure products separately would now all be targeted at a larger level because the CRC would connect their similar requirements. Industry could then sell more products across the DoD instead of just to small niche markets. Furthermore, smart industry analysts with access to requirements could theoretically look for trend information and predict where requirements were headed or learn how to build their next product. This information would further save industry money by tailoring its research towards more relevant ideas instead of riskier ones. Another interesting approach would be to monetize the entry of capabilities into the CRC, thereby providing funding to industry and research institutions for their work.

Research institutions and academics would be incentivized to enter information about their low-TRL concepts if they were allowed to advertise their ideas to industry and the federal government. Private industry leaders or federal government decision-makers looking for the next good idea could target a search to find a research lab or academic institution that they could fund and then profit from later on. Research institutions and academics would benefit because the CRC would be providing them with necessary funding for what they are passionate about and for what would advance them in their academic careers. Additionally, research institutions and academics are often faced with

the challenge of converting ideas and concepts into final products available to end users. The CRC would aid in bridging this gap by connecting the researchers with private industry.

Acquisition and budget professionals would be incentivized by the promise of an easier process that also provided transparency and fast results. Overall, the benefits could be seen across the cost, schedule, and performance metrics tracked by the acquisition professionals. Cost could be minimized because there would be a greater likelihood of finding programs underway, instead of having to create a new technology or purchasing on multiple contracts. The schedule would be shortened because high-TRL products could be identified more quickly, and the amount of data available to the professionals would shorten the time necessary to make a decision. Lastly, product performance would increase based off of feedback entered by different stakeholders into the CRC at different points in the acquisition process. The positive and negative feedback would show acquisition professionals how the new products were being received and would provide information on how well industry was meeting the timelines agreed to.

IA and interoperability organizations that establish policy and standards for DoD acquisitions would be incentivized because of the opportunity to advertise to all stakeholders. The more stakeholders build products able to meet current policies and standards, the faster the acquisition process will become. Also, pre-C&A products would be searched for because they would be identified through the CRC and would take less time to get into the hands of the warfighter.

All stakeholders would be incentivized by a common goal of quickly providing warfighters with the latest technologies, which would save lives and allow warfighters to accomplish their missions. An additional and more direct approach to adding capabilities to the CRC would be for the federal government to require stakeholder input by law, such as they require industry to register in the federal contractor database (https://www.bpn.gov/ccr/default.aspx) and the Federal Awardee Performance and Integrity Information System (FAPIIS; National Defense Authorization Act for Fiscal Year 2010, 2009).

3. Security Risks

Laws provide boundaries for information sharing. The Federal Acquisition Regulation (FAR) and the Defense Federal Acquisition Regulation System (DFARS) provide an interpretation of the laws governing federal and DoD acquisitions. The FAR and the DFAR would establish the rules for sharing information within the CRC. Information already within the CRC and information being entered into the CRC would be tagged to identify its origin as well as any caveats associated with the viewing of the information. Additionally, classified information would be outside the scope of the CRC design presented in this thesis; another CRC for a classified network would be needed because of the extra security required. The classified CRC should be designed to search below its classification level and to take in all information.

The current policies and laws for acquisitions are set up to favor the federal government as opposed to industry. Agents of the federal government (anyone within the DoD) sharing information on the CRC would have the most access to information in the CRC. However, the most attention would need to be paid to the sharing of information between private industries and the CRC. Competitors would have to be restricted from seeing each other's proprietary work. Private industry would still benefit from insight into DoD research, individual requirements, interoperability, and IA information.

Access by foreign companies to the CRC would be a mitigated security risk. The DoD currently contracts with foreign companies as well as with companies based in the United States that have global workforces. These companies should not be denied access to the CRC. Partnerships exist in industry and academia that leverage foreign technology and knowledge. Shutting out these partnerships would also shut out the global collaboration between industry and academia.

Overall, the CRC would control information through permission settings based on who was requesting it. The CRC would use redaction for information that was protected and would provide contact data if it was necessary for other stakeholders to have access to the information.

4. IA/Interoperability

The CRC would have a large impact on the interoperability and IA C&A of systems to be acquired. Combining the knowledge of the NIST, the NSA, and the JITC would provide stakeholders with a common location for baselines and standards. For example, the fastest way to acquire a widget is to acquire one that is already IA certified and accredited and JITC approved for interoperability. The CRC would contain all of this information, so the customer would be able to easily determine where the products were in the process of interoperability and IA C&A. The CRC could leverage efforts underway to provide this capability. Among these efforts are the NIST Cross Domain Solutions Office, the National Information Exchange Model, the DoD Metadata Registry, and the DoD IT Standards Registry. Individual efforts by organizations would benefit from the CRC's sharing of information because these organizations could leverage more economies of scale.

5. Transparency in Contracting

The CRC would allow transparency for capabilities in the existing contracts. In other words, if a search for a capability found an existing contract vehicle in a different organization, but still under the DoD umbrella, it would benefit the user. The user could, in theory, work out an agreement (Military Interdepartmental Purchase Request funds) to use the existing contract vehicle and to satisfy their own requirement in an expeditious way because the administrative work would have already been done by someone else. DoD Enterprise licensing is a great example of how the entire DoD benefits from sharing a single requirement, such as Adobe® Connect™, across all Services (Johnson, n.d.).

6. Added Benefits

The Federal Technology Transfer Act of 1986 directed the DoD and Federal Laboratories to make a focused effort to transfer federal research ideas to private industry for the benefit of the consumer and state and local governments. This law has created organizations (e.g., the National Technical Information Service and the Federal Laboratory Consortium for Technology Transfer) that are responsible for ensuring federal

law is not violated (Federal Technology Transfer Act of 1986). The National Technical Information Service functions as a central point for the collection, dissemination, and transfer of information on federal technologies and would be part of the CRC network (Department of Commerce, n.d.). The CRC would be a useful tool for these organizations because it would be proactive and would bridge private industry and the federal system. The CRC would reduce the time and cost to transfer technologies from the government to the public through the advertisement of government technologies to industry. The main reason for the reduction in time and cost would be because the database of research ongoing under the DoD would be updated to industry without the researchers having to put forth much effort. Therefore, time and cost would be reduced because industry would have direct insight as to what the government is focusing on and, therefore, likely to buy at a future time.

The CRC would provide the ability to leverage more of the scientists and researchers in the Federal Laboratory Consortium (http://www.federallabs.org). The system could couple researchers who are working on similar projects in order to encourage collaboration across physical boundaries. The CRC would allow the DoD to utilize the federal government's existing investment in research and development through access to their ongoing information. Also, the CRC would be beneficial to the DoD and the federal government because there are many instances in which labs and research institutions produce new widgets but fail to initialize and act on a plan for the adoption and transfer of their new technology to private industry. The CRC would connect the REIT under development to the users who need it, facilitating communication and coordination between different offices within the federal government such as the Office of Research and Technology Applications and the National Science Foundation.

Connecting the stakeholders in the CRC would provide the added benefit of exposing acquisition professionals (customers) and requirements generators to subject-matter experts. This approach would allow multiple experts to be questioned for a consensus-building effort instead of trusting a single expert to decide the fate of a complex program.

The CRC should be enabled to pull data from online financial resources as well as from government resources. Websites such as Google Finance (http://www.google.com/finance), Yahoo Finance (http//:www.finance.yahoo.com), and Bloomberg (http://www.bloomberg.com) all have specific financial information that could be used to help establish the health and validity of a company.

Historical information can sometimes be valuable in helping current and new programs through the acquisition process. Categorized programs completed or underway would be advertised to the user in order to show examples of failures and successes for the benefit of all the stakeholders. Examples of programs should also be categorized using a rating system to show how good or bad the acquisition was from the perspective of the user and the government. It could also be helpful to break down each acquisition into the components of the process in order to show the quality of localized events, such as "good" in IA but "bad" with interoperability. These assessments are subjective, but if they helped all parties reach a common ground, then their inclusion would be beneficial.

The CRC is a new system designed to decrease the time it takes for REIT to go through the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. The way this is accomplished is through incentivizing stakeholder involvement, structured information sharing, and bridging technologies. The CRC aims to become the portal application that leverages the rest of the acquisition resources and technology throughout the DoD.

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IV. BARRIERS TO ADOPTION

The CRC will face technical, cultural, and policy barriers that might prevent its adoption by the DoD. Although these barriers exist, some of them are slowly being broken down by new technologies and new ideas. In this chapter, these technologies and the barriers they attempt to overcome are explored. The CRC, like all new technologies, will have to overcome these barriers to adoption.

Four technologies that are already in use by some commands within the DoD will be discussed. The proposed technologies will directly improve the process of IT acquisition as well as the acquisition of all products and services involving REIT. The technologies are web portals, automated JCIDs, information assurance test ranges, and financial software. The purpose of discussing these technologies is to demonstrate that new concepts are not only possible but also currently in practice and already improving defense acquisition. The technologies described will provide improved information and knowledge to the CRC.

A. TECHNOLOGICAL BARRIERS

1. Portals and Adoption

Commands should utilize web portal technology, such as Microsoft SharePoint, instead of routing hard-copy documents or attempting to manage document changes through e-mail. Routing, editing, and approving documents involved in the acquisition process can be accomplished more efficiently through the use of digitized documents on a web portal or similar technology. One important requirement of web portals is the security and authentication of the documents and users. Secure systems, such as the public key infrastructure (PKI), and encrypted systems used by the DoD are a necessity.

Portals offer e-mail or other notification (e.g., text messaging) of document status changes to stakeholders in order to speed the acquisition process. Changes made to a file are instantaneously updated and tracked for all others to see. Another important feature of web portal technology is the ability to put time constraints on documents, forcing users

to edit and approve them before a deadline. Document version control is also a key aspect of web portals, especially when working with large groups of people. It is difficult to maintain a master version of a document when everyone is coordinating changes through e-mail. The ability of web portals to maintain a single version online with traceability of edits is important to prevent version duplicity.

To take version control and web portals one step forward, a new technology called *Google Wave* allows multiple users to edit files simultaneously, negating the condition in software that normally occurs when two processes of execution depend on a shared state. Using Google Wave also allows anyone to start at the beginning of the changes made to a document and walk through them in linear fashion (Google, 2010).

If a command requires printed paper to route documents for editing, validation, and approval, then valuable time is wasted in the acquisition process. The CRC and other technologies such as portals should be incorporated into policies and procedures in order to expedite all processing of administrative documents required for the acquisition of REIT and, in general, all products and services.

2. Automated JCIDS or Semantically Informed Dynamic Engineering of Capabilities and Requirements

Automated JCIDS is a software effort under development through MARCORSYSCOM's Intelligence, Surveillance, and Reconnaissance Enterprise to demonstrate an effective capacity to automate the DoD JCIDS system. The JCIDS defines acquisition requirements and determines evaluation criteria for DoD programs, and it is a subpart of the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. The current JCIDS is complex and requires individual DoD organizations to produce and maintain capability development documents and initial capability documents for every program. These documents do not show common relationships between programs. Automated JCIDS is also referred to in the commercial industry as Semantically Informed Dynamic Engineering of Capabilities and Requirements Automated (SIDECAR) (Lenat & Rode, n.d.). The four main components of Automated JCIDS are as follows:

- A front-end template. This template follows a model similar to TurboTax by providing a user-friendly interface and help features. The system would take input on a new REIT's requirements, constraints, and measures of performance.
- A back-end database. This database can be searched and cross-referenced. Automated JCIDS takes user input and compares it with the information it knows to create necessary documents such as the capabilities development document. The system continues to ask the user questions in order to complete all of the documents the system finds related to the program.
- Back-end models and algorithms. "Back-end models and algorithms that cross-reference and transform the various views in the inventory to create on-demand snapshots of the current state of alternatives and/or compliance" (Lenat & Rode, n.d.).
- Multiple file formats. In order to meet DoD requirements, Automated JCIDS generates all of the required documents in desired formats.

The Automated JCIDS takes the system features to be acquired as an input and guides the user through a step-by-step graphical user interface (GUI) in order to complete the documents required for the DoD JCIDS in accordance with rules and regulations. The system adds documents and asks additional questions based on the input from the user and back-end rules; as a result, the user is not required to remember all of the documents and rules needed, or be afraid of forgetting one. The added benefit to this system is its efficiency and accuracy in filling out forms while maintaining focus on content. Even when programmed correctly, software applications can make mistakes—but not as many as humans can make. The entire process is guided and is, therefore, designed for novice- and expert-level acquisition professionals. The expert users of the system have the option to see the original acquisition documents and directly edit them instead of using the GUI.

The requirement of an individual to know all of the documents in the JCIDS Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System is a daunting task. To add further complexity, the documents overlap each other in the content of the information required. This redundancy wastes users' time because they are required to fill in the same information multiple times throughout the process.

The Automated JCIDS system will identify these areas, request information one time, and fill in all necessary instances in which this information is required.

Overall, the Automated JCIDS software will be a benefit to the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System because it is efficient and cuts down on the time necessary to complete all of the paperwork required by the current system. Also, Automated JCIDS simplifies an acquisition professional's job because it does not require the individual to remember all of the DoD statutory and regulatory policies and directives.

3. Rapid IA Testing and Accreditation

In a perfect world, REIT software and hardware could be tested on an operational network to verify IA certification, interoperability accreditation, and functional success. Today, technology exists for organizations at the local and enterprise levels to directly replicate their operational networks at a lower cost than building two duplicate networks. Using VMware, servers, and packet and pipe replication, enterprises can directly mirror their operational network down to all the programs running on it by using the same Internet Protocol scheme and using an IA test range.

A DAA-approved IA test range could be used to quickly certify and accredit new REIT systems for IA and interoperability. The IA test range would be faster than normal because it would allow private industry to work on an operation-like network from the beginning to the end of a product's development, making it so that the industry would not have to wait until demonstration times to see if the product would fail.

The use of the test range would give acquisition professionals a more accurate picture of how the new REIT will function on the operational network without impacting the operational network with an outage, security risk, or added latency. The IA and interoperability organizations would benefit because the systems produced would be more likely to meet all the required standards and would have been tested thoroughly instead of just at baseline instances in time.

The IA test range concept is currently being used in the DoD by some organizations and is under development for the Marine Corps by MARCORSYSCOM. The relatively low cost of acquiring this technology makes it a viable solution to help expedite IA and interoperability certification and accreditation. Under the current process, if all the proper procedures are followed, then IA certification alone takes a minimum of a year and a half. A well-executed IA test range could accomplish the IA certification in months instead of years.

4. Rapid Procurement Vehicles

There are many different software efforts underway as well as in use across the DoD that create Quicken-like financial software features for the DoD according to how it budgets and executes spending within the FAR and the DFARS. The problem associated with the multiple programs is the lack of standards for sharing information between the distinct software solutions. If the software is proprietary and if each organization in the DoD uses a different one, then it is obvious how difficult it would be to get an accurate picture on a macro level. Additionally, if Quicken (or something like it) is not used, then the default alternate within the DoD is a massive Excel spreadsheet or some other proprietary, DoD-specific software. The DoD will only be able to execute its budget efficiently if there is an enterprise-level directive that mandates the use of the most capable interoperable software across the DoD.

Furthermore, transparency within organizational chains of command is necessary to fully execute the budget. If a command is able to better track its budget, then it will have earlier insight into programs that are not performing and that could possibly fail in the future. Additionally, at an enterprise level, a senior command organization would have instant, up-to-date access to its subordinate’s budget in order to verify budget appropriations and to move money, if necessary, due to failing programs or new requirements. To compare this to banking software used in the home such as Quicken or to the online variant called Mint.com (http://www.mint.com), it would be useful to tie monetary transactions in and out of the treasury account to automatically update the QuickenGov software.

One simple proposal is to hire Intuit, the maker of Quicken, to produce software for the DoD and for the federal government. Quicken is arguably the commercial company with the most talent in financial software, now that Microsoft has cancelled its Microsoft Money software. After the software is developed, it could be integrated in the policies and procedures of the DoD. The end state of this integration would be a full, detailed budget report for Congress at the push of a button.

5. Classification

Manually classifying all current, new, and old DoD programs by capabilities and by topic and subtopics would be an overwhelming task. Therefore, an automated classification approach should be used. Through classification of old documents, the CRC would leverage the legacy systems in existence.

The best current technology in automated classification is Statistical Machine Learning (SML; http://sml.nicta.com.au). The benefit to using SML is the extra steps it would allow a system to take to improve the accuracy of its classification and searching of acquisition documents. Document classification is easier in the case of acquisitions because the forms are more structured. In the following subsections, some example approaches for improving the accuracy of classification and searching are presented.

a. Validated Documents

The best approach to increasing SML accuracy is to provide the CRC with validated documents from which to learn. Validated documents are those that have been approved by acquisition professionals in content and format. Additionally, the DoD acquisition professionals who are most experienced should validate the best requirements, acquisition, and budget documents currently available by category and use them to start the learning process of SML. It is better to use a few validated documents than to use multiple documents that have been incorrectly completed.

b. Online Resources

The CRC could add a large amount of information to its knowledge base from other online resources through its push-pull capability and from SML. As data is pulled into the CRC, it could be put through the SML filter to add information and raw data to the CRC knowledge base; it would not save all information, only the metadata and information needed for the CRC to know where to go when information is required.

c. Human Involvement

No SML system is perfect. In order to provide more accurate results, humans should be involved in randomly looking over the classification done using the SML. In addition to human verification, it would be important to allow all stakeholders to provide feedback to the system to make it more accurate. Two examples of the use of this method in private industry are Pandora Internet Radio (http://www.pandora.com) and Amazon.com (http://www.amazon.com). Both companies provide feedback mechanisms to make their applications stronger in providing better music results or a better shopping experience, respectively. Pandora offers a simple “thumbs up” or “thumbs down” feedback system, which allows its algorithms to learn whether the song suggested by the system matches what the user likes or originally asked for. The Amazon.com feedback system allows a user to rate products through a star system and text input. This information is then associated with the user’s account and run through the system’s algorithms, which then make suggestions about other products the user might like to purchase. These two examples demonstrate how both the enterprise system and the user benefit from feedback systems. The CRC should employ the concept of a feedback system in order to maintain search accuracy.

d. Additional Feedback

All systems that interact with people should learn from their users’ actions. A powerful feedback input to the CRC would be from the end user, or the warfighter. The warfighter would provide input on actual systems that were fielded or

under development. This input would give direct feedback to industry for product improvement and would also tell the acquisition professionals where to focus their spending.

Feedback from the warfighter would be extremely important, but feedback from more than just the warfighter would be necessary in order to make a better CRC. The stakeholders should also be able to rate each other's products, processes, and abilities. The companies that receive justified negative feedback should quickly be identified to the acquisition professionals and, in theory, lose business. A simple star rating with the option of adding amplifying text could be used to rank many aspects of the CRC. Amazon.com (http://www.amazon.com) is an example of a company that is an industry expert in this field.

6. Technology Barrier Overview

One policy required throughout all of the technologies listed in the previous subsection is the need to authenticate and validate who is on the CRC and who is making changes to it. Therefore, in addition to the technologies listed, it is important to incorporate the DoD CAC procedures using PKI.

Again, technologies do not provide all of the answers for fixing the Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System. However, they do provide solutions to solve some of the problems within the system. The technologies listed in this chapter have all been developed for use commercially or for the federal government specifically and have shown success in their results. The DoD should adopt and invest in as many of these successes as possible.

Outside of the technology barriers the CRC will face in its adoption, there are additional cultural barriers that will pose more of a challenge to its adoption. Human behavior is a difficult field of study because there are many intangible aspects. The CRC will face a DoD culture steeped in tradition and a stereotypical lack of innovative thinking.

B. CULTURAL BARRIERS

Across the DoD there are many different cultures involved in the acquisition of REIT. In this author's opinion, the cultural barriers to adoption involve the emotions of individuals, power struggles, and self-importance. The CRC and other technologies discussed in this chapter are technologically possible or already in use by consumers today. However, just because the technologies are possible does not mean that the cultural barriers they will face for entry into the DoD will be easy. Longstanding cultural attitudes and beliefs within the DoD, such as group think, make it difficult for individuals to embrace new ideas and methods for solving problems (Hewson, 2005). The defense acquisition culture has increasingly been tied down by bureaucratic requirements, self-imposed and external, that have led the culture to become one with the status quo.

Cultural barriers will need to be broken in order for acquisition professionals to embrace the new concept of the CRC and the benefits it will bring to defense acquisition. The CRC's initial success will require funding, research, policy changes, and a product demonstration. In this author's opinion, these components, along with the CRC concept, will lead to a successful project start.

1. Eighty Percent Versus One Hundred Percent Mentality

The nature of the work the DoD is involved in has created a culture of zero failure (100% solution) and perfection with regard to the requirements set for systems, services, and equipment. This cultural norm is justified in many cases; however, it cannot be justified in all cases of REIT. This mentality is a barrier to the CRC and to acquiring REIT because it does not allow for evolutionary development, which is based on the principle of developing solutions through improvements iteratively (80% solution), possibly never reaching a 100% solution. Most people look at zero failure in the wrong way: failure is either optimal or epic. An epic failure is one that wastes large sums of money and provides no feedback to the system. An optimal failure is one that does not waste a lot of money and provides constructive feedback to the system. Optimal failure

is obviously desired. However, failure itself is a tough concept for most people, especially within the DoD, to accept. The CRC would show the benefits of both the 80% and 100% solutions by providing in-depth background information and analyses.

V. EXECUTION

In this chapter, some steps that could help Collective Acquisition get traction within the DoD or federal government are described. One of the early keys will be finding both civilian and military champions of the process who can effectively market it. A prototype CRC would help in this regard, but without major funding up front to develop a nontrivial prototype, marketing could prove difficult. As a result, it is essential that proponents of the idea secure some initial funding for it.

It will be necessary at the Senior Executive Service (SES) to have a proponent who controls funding and can influence policy. For this reason, it will be necessary to have a three- or four-star flag officer on the Joint Staff and one of the Under Secretaries of Defense who support the CRC. This senior top cover will be necessary because such leaders can override the cultural barriers the CRC will face as a new concept that challenges the normal way of doing business. Lower-level civilian and military operational champions will be necessary because they will fully understand all of the complexities of the CRC and will be able to explain them in a nontechnical way. It will be important to have as many senior and junior military and civilian operational champions from the original stakeholder list as possible. Among them are the following:

- Requirements generators,
- Private industry,
- Government research labs and institutions,
- Acquisition professionals,
- Budget professionals,
- IA organizations and policy-makers, and
- Interoperability organizations.

The more stakeholder involvement, the easier it will be to justify the CRC. It is also important to note that voluntary involvement in the project will provide an important foundation of information to the CRC. If a stakeholder cannot be convinced to voluntarily contribute to the CRC, then this would likely demonstrate to others a lack of

confidence in the system, resulting in the failure of the program itself. The CRC could be viewed as a threat to jobs and the status quo; therefore, the lower-level champions will be essential for explaining the CRC in nonthreatening terms to those who feel the system threatens their jobs. This will be necessary in order to gain their support and demonstrate the benefits of the CRC.

A. PROOF OF CONCEPT

The initial cultural barriers to entry that the CRC will face can be mitigated through the use of the operational champions. However, this is only a temporary solution and will not provide all the necessary components nor funding to the CRC. In order for the CRC to reach its full potential, it will need to be championed at the federal level and at the commercial-industry level, both of which provide products and services to the DoD. In an ideal situation, the initial operational champions will have provided enough research, funding, and top cover for a significant prototype to be built. The CRC prototype, in combination with the senior operational champions, is necessary to convince other noninnovators of its necessity and positive evolutionary impact.

To succeed, it will be necessary for Congress to appropriate adequate funding to the CRC, but, more important, Congress will need to require by law that industry and the federal government provide the necessary input to the CRC. This requirement will be necessary because the stakeholders will not all voluntarily participate in the project. The inclusion of all of the initial stakeholders is important because the CRC will not reach its full potential without them.

Congress will not be hard to convince of the benefits as long as a CRC proof of concept can be demonstrated to streamline the efficiency of defense acquisition, cut out waste, save money, and provide incentives to small and large businesses for jobs to their constituents. The perfect CRC demonstration would include the acquisition scenario listed in Chapter I and a background visualization of the cross-domain resources the CRC was able to bridge in order to come to its recommendations. This would not be a new concept for Congress since they have made laws in the past requiring the DoD and

industry to comply with new concepts (e.g., industry registration in a contractor database). Congress carries a "big stick" when it comes to industry involvement because they can withhold income from companies that do not comply with their mandates. Ideally, every stakeholder will voluntarily comply with the CRC because of the incentives and evolutionary benefits it will provide. Congress will be helpful in persuading the members of industry and the federal government who do not want to lose their stovepipes of profit and power. Another simple example would be for the CRC to show waste in the defense acquisition system by identifying two organizations (e.g., the Navy and the Marines) that are about to purchase nearly the exact same product or service. The CRC would proactively show the waste and provide more information about the two companies from which the Services intend to make a purchase. In the same manner, the CRC could expose corrupt companies that are trying to double dip and sell the same product to the government under two different contracts.

It is important to demonstrate the initial capability of the CRC to Congress and others in order to gain constructive feedback and prove that money is being spent wisely. The evolutionary way in which the CRC will be developed should also produce demonstrations at the end of each iteration. By demonstrating continued success and management of expectations, the DoD will gain more support for the CRC.

B. INDUSTRY ACCEPTANCE

Federal government stakeholders are the most likely to participate because they are governed by federal law. Private industry is a different story. In this author's opinion, although private industry is obligated to obey the laws of Congress, they have more money and lawyers to fight new concepts when faced with competition. The incentives discussed in Chapter III will ideally bring private industry to understand the CRC opportunities because they will feel the benefit from the CRC. In order to minimize noncompliance and grow rapid support within industry, it will be important to design the CRC to be as open, secure, and user-friendly as possible. The CRC human computer interface should be thoroughly tested. The easier and more automated the system is, the

less likely there will be resistance from the stakeholders. In the end, it is all about making the CRC a positive experience by making it nearly effortless for stakeholders to participate in the CRC interface.

C. OVERCOMING DEMOTIVATION

People are the most important asset of the DoD, and they are crucial in performing the tasks required by the defense acquisition system for new projects. In this author's opinion, people can be further grouped into categories of motivators or demotivators. A motivator will always maintain an open mind with regard to new concepts, work hard at what they do, and, in general, see the big picture when it comes to acquisitions. Unfortunately, the DoD is also full of demotivators. Demotivators could be good at what they do, but, in general, "no" is their first answer to anything outside the norm or to anything that could possibly put them out of a job or require them to do work they are not used to doing. The CRC will face the demotivators at the peak of their demotivation because the CRC will threaten the normal way of business and could be seen as an attempt to automate human involvement in defense acquisition. For this reason, it will be crucial to identify the demotivators as early as possible and to determine the best way to work around or replace them. These individuals should not immediately be dismissed because they possess core knowledge about who can get things done when needed. The CRC will aim to help these individuals be more efficient and streamline their work, potentially turning them into motivators. The CRC will provide a collaborative environment full of motivators and other experts that will allow users to easily bypass the demotivators. The other important combatants in the fight against demotivators are the senior operational champions. The benefit of being a senior leader in a vertical organization is having the ability to defeat demotivators through orders, reasoning, or removal from projects. These senior leaders will be necessary in order to convince others that the CRC is an important evolutionary step in the future of acquisitions.

D. FOCUS ON EMOTION

In this author's opinion, the one commonality across the federal government with regard to defense acquisition is the deep feeling (i.e., frustration) that work could be done more efficiently and could produce better results. This feeling, evoked when anyone within the DoD is asked about the acquisition system, could be used as a strong enabler for the CRC. The feeling of frustration stirred by the acquisition system can partly be mitigated with the use of technology. The criterion for mitigation is adoption of the technology into the normal operations of the acquisition system and the simplicity of that technology. In this author's opinion, people are most likely to try something new when they are extremely disappointed with the current system.

As discussed in Chapter IV, feedback is an important aspect of the acquisition process because it gives individuals a sense of importance and provides valuable information to the CRC. The feedback from seeing direct results based on an individual input is an important feature that the CRC will provide. The feedback within the CRC could make a contribution to a cause that an individual knows will help him or her save a life in the future, such as a recommendation for changing the design of a critical piece of communications equipment.

E. OPERATIONAL COMMAND INVOLVEMENT

The operational commander should be involved in the process for acquiring technology relevant to his or her mission. This involvement would provide a commander with the means of making the decision on the value of bringing in an early technology with the 80% solution, as long as he or she made the decision knowing the associated risks. Furthermore, commanders would provide direct feedback into the decision cycle, which would benefit future iterations of the REIT and provide feedback to the DoD about whether the 80% is a quality REIT or whether it does not meet the requirements. The CRC would stay involved throughout the entirety of this process and would provide the operational commander with extra resources (e.g., subject-matter experts).

F. ACCOMMODATING

Initially, the CRC would not replace any systems; therefore, it would not threaten any powerful stovepipes existing in the federal government. If people are made to feel that their power base will gain importance rather than be threatened, then they will be more likely to support aspects of the CRC. An effort should be made to brand the CRC as a third-party application that would not take money or resources away from any program, but rather enhance what is already underway. In the future, if the online resources were found to be more efficient under the CRC umbrella, then the system would be made open enough to envelope them, but this decision would be made by future policy-makers.

G. DEFENSE ACQUISITION UNIVERSITY

In addition to showing a prototype CRC and explaining the value the CRC will bring, an important emphasis should be made with regard to the Joint Forces going through DAU training and certification. Because students are impressionable, they represent the easiest way to spread information when they enter the workforce. Students would easily adopt the CRC as a new concept and would continue to provide momentum for the CRC project.

VI. SUMMARY AND FUTURE WORK

A. SUMMARY

The DoD is burdened by an Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System that is designed to acquire large systems, such as ships, and that takes years to complete. Information technology evolves at a rapid pace because it is driven by industry. The DoD acquisition system is therefore at odds with industry development, at least with respect to information technology. The acquisition of information technology cannot follow the same path as a ship if the DoD wants the warfighter to have the most advanced technologies.

The current acquisition process is burdened with many obstacles. It is an artifact of an industrial–military alliance that has evolved over many years. As such, it is riddled with special provisions, regulations, directives, best business practices, etc., that have become a veritable mine field to navigate. Other obstacles include a DoD culture and larger political environment that together add multiple layers of bureaucracy and uncertainty to the process. It is unrealistic to expect a clean slate in order to begin designing a totally new process. Realistically, as much current practice as possible has to be incorporated in order to make any real progress. To understand what incorporation means, current practice needs to be understood—not at the level of published procedures, but rather at the level of the trenches or frontlines where real acquisition decisions are made today. To that end, the author embedded himself in three system commands over a period of 12 months to observe operations. The author observed several areas in which improvements are needed, among them are policy, laws, education, and culture. This thesis recommended changes that should occur in the acquisition process for the types of technology that evolve very quickly.

One of the changes that needs to occur is the sharing of information about a variety of things. The acquisition of technology is about much more than the technology alone. Each stage of the acquisition process, even for technologies that are never ultimately adopted, offers some information that needs to be cataloged in a way that

makes it useful to others. This thesis proposed a clearinghouse for this purpose, called the Capabilities and Requirements Clearinghouse (CRC). The CRC would decrease the amount of time required to get information technology to the warfighter. It would do so by relating existing resources, automatically crawling through data, and providing a single source of information for all aspects of acquisition. The DoD loses some of its ability to acquire information technology because economies of scale are not maximized through the relationship of program information. The lack of relationships between online resources and databases causes many steps to be repeated. Going forward, it will be unacceptable to maintain stovepipes of web resources. Instead, the online resources will need to be integrated, and the CRC provides a framework for accomplishing this.

The changes that need to occur are not limited to information sharing. Although that is a central component, other barriers must be overcome. These barriers are in the following areas:

- Certification and accreditation,
- Budgeting flexibility,
- Testing and validation, and
- Cultural hurdles.

Currently, certification and accreditation involve many parties, such as the NIST, the NSA, a Service's DAA, and so on. The process produces artifacts such as FIPS certificates and test suites within which products are certified. These artifacts may be used in the certification of new products. For instance, a cryptographic module's certificate may be reused to certify another product if that product uses the same module. How do we know which module was used? How do we know in which environment the module was tested? The answers to these questions would be available through the CRC, which would catalog information along many different axes.

The DoD's Planning, Programming, Budgeting, and Execution process is not transparent or flexible enough to accommodate the pace at which information technology evolves. In order to improve this, a Quicken-like software package is recommended.

The package should be mandated DoD-wide in order to share budget information across the Services and to provide greater visibility into budget issues. This way, budget problems will be revealed earlier.

As far as testing and validation is concerned, relatively fewer changes seem to be needed. The reason is the IA test range already provides a configurable network test environment to facilitate testing. It appears that one of the major shortcomings of the range is its ability to interface with other data repositories like the CRC. For instance, knowing the exact configuration cataloged by a vendor would allow a DAA to more quickly compare products from different vendors because knowing the configuration would level the playing field.

The cultural hurdles will be more difficult to overcome and will require decision-makers to improve the system by evaluating and merging current DoD acquisition rules. Removing duplicate rules and requirements that require extra work will be the fastest way to improve the acquisition system. In addition, the cultural belief that 80% perfection is a failure needs to be better explained with regard to information technology. An iterative process that produces only an 80% solution is often adequate. Some professionals find this difficult to accept and need to adapt.

B. FUTURE WORK

In order to execute the CRC, a significant amount of effort will be necessary to build, validate, and test the conceptual idea. Additionally, work will need to be done to relate the online resources and explore the technologies discussed in this thesis. The goal of future work should be to improve on the foundation presented in this thesis and produce a CRC prototype.

The CRC will most importantly need both DoD and congressional champions in order to be successful. These champions should make efforts to rally for support of the CRC in their respective organizations and push for consolidation of resources. In addition, effort will be necessary to motivate others to review current and past policies, laws, and rules in order to simplify and streamline them. These will have a direct,

positive impact on the CRC. Within the DoD, the first champion should be the Defense Advanced Research Projects Agency (DARPA) and the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics. These organizations have the money, resources, and expertise to nurture the CRC. It is key to get initial validation, or a toehold, by an agency actually acquiring information technology. An example of such an agency is the Defense Information Systems Agency (DISA).

Current federal laws and DoD policy documents dictate the rules for who, what, when, where, why, and how an individual, company, or organization can share information within and outside the DoD and federal government. The number of documents, policies, laws, rules, etc., is far too great for any one person to master. These rules will need to be codified and represented within the CRC so that no violations occur. Therefore, research will need to be done to create a database of all rules and their dependencies and to represent them in the CRC.

The list of online resources in Appendix D is a very brief list of what is available to the DoD and federal acquisition communities. Research is needed to identify all of the additional websites and databases that will need to be identified in order to relate or consolidate resources. The overlap of resources is a key area of study that needs attention. Additionally, the information and data contained in the identified resources will need to be organized and plugged into the CRC so that it may serve as the front end to these resources. Further research is required in the categorization of the information and data using SML, as discussed in this thesis.

Further research is needed to identify how technologies such as the proposed QuickenGov and Automated JCIDS would relate to the CRC and other new resources identified. Specifically, research into technology and the level at which it is interoperable with the CRC will need to be identified.

In Chapter V, the many issues that the CRC will face with regard to social science were discussed. Further research is needed to study how the CRC will impact the emotions of DoD personnel. Also, more research is required as to how human emotions by personnel in the DoD will impact and drive the CRC.

As much as possible, all aspects of the CRC should be kept at an unclassified level. However, if a higher classification of the CRC is needed, then it should be carefully engineered with the ability to cross enterprise domains in order to pull information. Research will be needed to determine how to set up this relationship between software programs on different domains as well as how to control multilevel access to information.

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APPENDIX A. HARDWARE AND SOFTWARE TECHNOLOGY READINESS LEVELS TABLE

Technology Readiness Levels (TRLs) are metrics used by the DoD to determine the maturity of rapidly evolving technologies. This maturity can then help the DoD determine the risk for adoption of the technology. Furthermore, TRLs are a way for acquisition professionals to estimate how much time it will take for a technology to reach completion or production. See Table 1 in this appendix for a full list of the definitions of TRLs as defined by the DoD Technology Readiness Assessment (TRA) Deskbook (2009).

Table 1. Definitions of Technology Readiness Levels

Hardware TRL Definitions, Descriptions, and Supporting Information			Software TRL Definitions, Descriptions, and Supporting Information		
TRL Definition	**Description**	**Supporting Information**	**TRL Definition**	**Description**	**Supporting Information**
1 *Basic principles observed and reported.*	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development (R&D). Examples might include paper studies of a technology's basic properties.	Published research that identifies the principles that underlie this technology. References to who, where, when.	**1** *Basic principles observed and reported.*	Lowest level of software technology readiness. A new software domain is being investigated by the basic research community. This level extends to the development of basic use, basic properties of software architecture, mathematical formulations, and general algorithms.	Basic research activities, research articles, peer-reviewed white papers, point papers, early lab model of basic concept may be useful for substantiating the TRL.
2 *Technology concept and/or application formulated.*	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.	Publications or other references that outline the application being considered and that provide analysis to support the concept.	**2** *Technology concept and/or application formulated.*	Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies using synthetic data.	Applied research activities, analytic studies, small code units, and papers comparing competing technologies.
3 *Analytical and experimental critical function and/or characteristic proof of concept.*	Active R&D is initiated. This includes analytical studies and laboratory studies to physically validate the analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.	Results of laboratory tests performed to measure parameters of interest and comparison to analytical predictions for critical subsystems. References to who, where, and when these tests and comparisons were performed.	**3** *Analytical and experimental critical function and/or characteristic proof of concept.*	Active R&D is initiated. The level at which scientific feasibility is demonstrated through analytical and laboratory studies. This level extends to the development of limited functionality environments to validate critical properties and analytical predictions using non-integrated software components and partially representative data.	Algorithms run on a surrogate processor in a laboratory environment, instrumented components operating in a laboratory environment, laboratory results showing validation of critical properties.
4 *Component and/or breadboard validation in a laboratory environment.*	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared with the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.	System concepts that have been considered and results from testing laboratory-scale breadboard(s). References to who did this work and when. Provide an estimate of how breadboard hardware and test results differ from the expected system goals.	**4** *Module and/or subsystem validation in a laboratory environment (i.e., software prototype development environment).*	Basic software components are integrated to establish that they will work together. They are relatively primitive with regard to efficiency and robustness compared with the eventual system. Architecture development initiated to include interoperability, reliability, maintainability, extensibility, scalability, and security issues. Emulation with current/legacy elements as appropriate. Prototypes developed to demonstrate different aspects of eventual system.	Advanced technology development, stand-alone prototype solving a synthetic full-scale problem, or standalone prototype processing fully representative data sets.
5 *Component and/or breadboard validation in a relevant environment.*	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment. Examples include "high-fidelity" laboratory integration of components.	Results from testing a laboratory breadboard system are integrated with other supporting elements in a simulated operational environment. How does the "relevant environment" differ from the expected operational environment? How do the test results compare with expectations? What problems, if any, were encountered? Was the breadboard system refined to more nearly match the expected system goals?	**5** *Module and/or subsystem validation in a relevant environment.*	Level at which software technology is ready to start integration with existing systems. The prototype implementations conform to target environment/interfaces. Experiments with realistic problems. Simulated interfaces to existing systems. System software architecture established. Algorithms run on a processor(s) with characteristics expected in the operational environment.	System architecture diagram around technology element with critical performance requirements defined. Processor selection analysis, Simulation/Stimulation (Sim/Stim) Laboratory buildup plan. Software placed under configuration management. Commercial-of-the-shelf/government-off-the-shelf (COTS/GOTS) components in the system software architecture are identified.
6 *System/subsystem model or prototype demonstration in a relevant environment.*	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in a simulated operational environment.	Results from laboratory testing of a prototype system that is near the desired configuration in terms of performance, weight, and volume. How did the test environment differ from the operational environment? Who performed the tests? How did the test compare with expectations? What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems before moving to the next level?	**6** *Module and/or subsystem validation in a relevant end-to-end environment.*	Level at which the engineering feasibility of a software technology is demonstrated. This level extends to laboratory prototype implementations on full-scale realistic problems in which the software technology is partially integrated with existing hardware/software systems.	Results from laboratory testing of a prototype package that is near the desired configuration in terms of performance, including physical, logical, data, and security interfaces. Comparisons between tested environment and operational environment analytically understood. Analysis and test measurements quantifying contribution to system-wide requirements such as throughput, scalability, and reliability. Analysis of human-computer (user environment) begun.
7 *System prototype demonstration in an operational environment.*	Prototype near or at planned operational system. Represents a major step up from TRL 6 by requiring demonstration of an actual system prototype in an operational environment (e.g., in an aircraft, in a vehicle, or in space).	Results from testing a prototype system in an operational environment. Who performed the tests? How did the test compare with expectations? What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems before moving to the next level?	**7** *System prototype demonstration in an operational high-fidelity environment.*	Level at which the program feasibility of a software technology is demonstrated. This level extends to operational environment prototype implementations, where critical technical risk functionality is available for demonstration and a test in which the software technology is well integrated with operational hardware/software systems.	Critical technological properties are measured against requirements in an operational environment.
8 *Actual system completed and qualified through test and demonstration.*	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation (DT&E) of the system in its intended weapon system to determine if it meets design specifications.	Results of testing the system in its final configuration under the expected range of environmental conditions in which it will be expected to operate. Assessment of whether it will meet its operational requirements. What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems before finalizing the design?	**8** *Actual system completed and mission qualified through test and demonstration in an operational environment.*	Level at which a software technology is fully integrated with operational hardware and software systems. Software development documentation is complete. All functionality tested in simulated and operational scenarios.	Published documentation and product technology refresh build schedule. Software resource reserve measured and tracked.
9 *Actual system proven through successful mission operations.*	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation (OT&E). Examples include using the system under operational mission conditions.	OT&E reports.	**9** *Actual system proven through successful mission-proven operational capabilities.*	Level at which a software technology is readily repeatable and reusable. The software based on the technology is fully integrated with operational hardware/software systems. All software documentation verified. Successful operational experience. Sustaining software engineering support in place. Actual system.	Production configuration management reports. Technology integrated into a reuse "wizard."

APPENDIX B. ACQUISTION OVERVIEW CHART

The Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System chart in Figure 3 shows complexity. The chart can be found on the Defense Acquisition University's website (http://www.dau.mil).

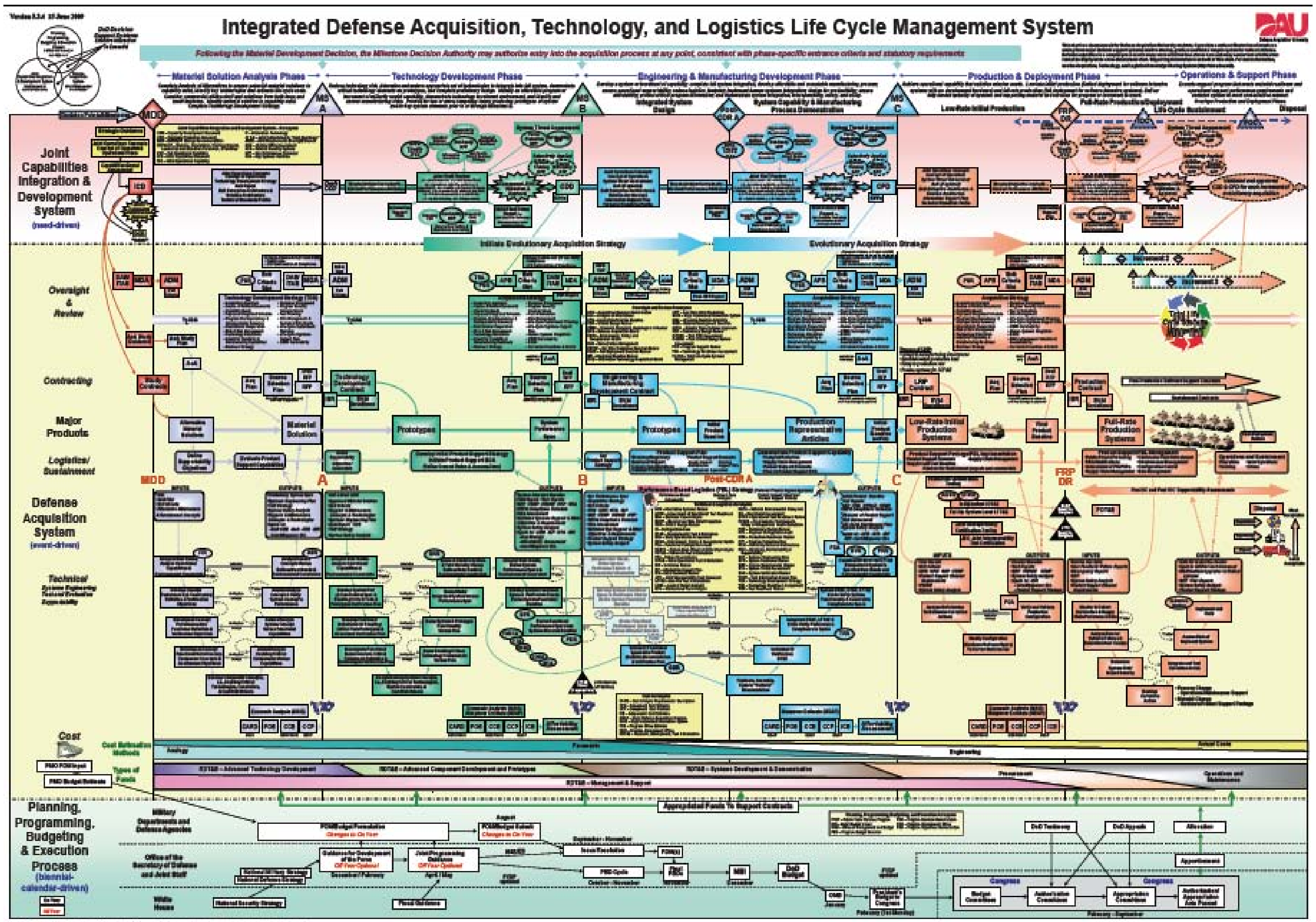

Figure 3. Integrated Defense Acquisition, Technology, and Logistics Life Cycle Management System (from http://www.dau.mil)

APPENDIX C. OPERATIONAL DEFICIENCY REPORT

The template below is a generic example of what an operational deficiency report could look like.

From: ________________
To: ________________

Subj: OPERATIONAL DEFICIENCY REPORT (ODR)

1. Operational Requirement. Provide a brief description and summary addressing the operational requirement (who, what, where, when, why, how).
    a. Capability Required. Describe what is required in operational terms. If possible, identify the system, equipment, component, procedure, etc., that will provide a solution to the operational deficiency.
    b. Operational Deficiency. Describe the existing operational deficiency (capability gap). Explain why existing systems or procedures fail to provide the results or effects required.
2. Concept of Operations. Outline the concept of operations (how would the required kit/system/platform, etc.) to be employed to overcome the operational deficiency.
3. Additional Supportive Information. Provide additional information, as available, that further clarifies/supports the requirement. For example,
    a. Will this be a new item, or will it replace an existing item/system?
    b. Give the potential technology or vendor.
    c. List other units/Services/organizations that have a potential solution or similar requirement.
4. ODR Sponsor Point of Contact.
5. Signature.

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APPENDIX D. ONLINE ACQUISITION RESOURCES

The following list describes some of the current online acquisition resources that should be consolidated or related to improve the Integrated Defense Acquisitions, Technology, and Logistics Life Cycle Management System.

A. DOD TECHIPEDIA

DoD Techipedia is a wiki sponsored by the Defense Technical Information Center (DTIC) that is designed to increase communication and collaboration among DoD scientists, engineers, program managers, and operational warfighters. This tool enables DoD personnel to collaborate on technological solutions, reduce costs, add capability, and avoid duplication through a common wiki (Department of Defense [DoD], n.d.c).

The CRC would gain an immense knowledge base from the DTIC because it is the largest central resource depository for DoD- and government-funded scientific, technical, engineering, and business information. Specifically, DoD Techipedia has created relationships between stakeholders (requirements generators, the Federal Laboratory Consortium, acquisition professionals, IA, and interoperability organizations) who have common interests within the DoD in order to leverage the collective power of the individuals in the federal system (DoD, n.d.c). This is one of the criteria that the CRC should provide. In addition to the service provided by DoD Techipedia, the CRC would add the remaining stakeholders (private industry and budget professionals) as collaborators who would contribute and find information based on their common interests.

B. DOD IT STANDARDS

DoD IT Standards was created by the Office of the Secretary of Defense (Networks & Information Integration) DoD Chief Information Officer, who is responsible for setting policy and providing oversight of information processes, systems, and technologies (http://cio-nii.defense.gov/). DoD IT Standards focuses on three major activities: policy development, program oversight, and acquisition support. The CRC

would benefit from the DoD IT Standards by pulling standards information from one up-to-date source. The CRC could then use this information to advertise information to private industry. Furthermore, the CRC could compare the standards to standards advertized by private industry as an extra step of verification for industry compliance (Office of the Secretary of Defense for Networks & Information Integration, Chief Information Officer [OSD(NII/CIO)], n.d.).

C. INFORMATION ASSURANCE SUPPORT ENVIRONMENT

The Information Assurance Support Environment (IASE) provides a single location for everything related to IA C&A and interoperability. Similar to the relationship between the CRC and DoD IT Standards, the IASE would provide essential IA C&A and interoperability sources to the CRC. An important aspect of the IASE is that it is fed by multiple supporting online resources such as the NIST Special Publications Computer Security Division (CSD), which is responsible for providing minimum standards and technology to protect information systems against threats. Furthermore, it hosts a growing repository of federal agency security practices, public and private security practices, and security configuration checklists for IT products (DoD, n.d.b).

D. CONTRACTOR PERFORMANCE ASSESSMENT REPORTING SYSTEM

A Contractor Performance Assessment Reporting System (CPAR) assesses a contractor’s performance and provides a record, including both positive and negative ratings, on a given contractor as dictated by the FAR (Defense Information Systems Agency [DISA], n.d.). CPARS is a web-enabled application that collects and manages the library of automated CPARs. Each assessment is based on objective facts and is supported by program and contract management data, such as cost performance reports, customer comments, quality reviews, technical interchange meetings, financial solvency assessments, construction and production management reviews, contractor operations reviews, functional performance evaluations, and earned contract incentives. The CRC would pull information from CPARS and relate that information to industry capabilities (past, current, and future). The CRC could use the CPAR data to provide amplifying

information to its query results for capabilities and could use the information to provide ratings for products and contractors. Because the FAR dictates that past performance information (PPI) be collected and used in source selection evaluations throughout the acquisition process, the CRC would show the relationships on a macro level in order to provide stakeholders with the right information so that they could make the correct acquisition decisions (DISA, n.d.).

E. GENERAL SERVICES ADMINISTRATION, SOFTWARE MANAGED AND ACQUIRED ON THE RIGHT TERMS

Software Managed and Acquired on the Right Terms (SmartBuy) is a federal procurement vehicle that provides faster licensed software and software-related services at considerable savings through established blanket purchase agreements (BPAs). The General Services Administration (GSA) offers the opportunity to view and select from an expanding list of COTS software. The CRC would pull information from SmartBuy to add to its knowledge base of products and their capabilities. As users or the system query the CRC, the SmartBuy data would provide an expedited existing material solution with a contracting vehicle. This is a great example of the CRC because it would match an existing capability with a current requirement. Furthermore, it would provide a quick means for acquisition because a contracting vehicle already exists for the DoD (General Service Administration [GSA], n.d.).

F. CENTRAL CONTRACTOR REGISTRATION

The Central Contractor Registration (CCR) fills the FAR requirement for contractors to register their companies in order to do business with the federal government. It collects, validates, stores, and disseminates data on all known contractors conducting business with the DoD (https://www.bpn.gov/ccr/default.aspx). The CRC would pull information from the CCR in order to build relationships between contractor names, numbers, and their products.

G. CONTRACTOR COST AND DATA REPORTING

Contractor Cost and Data Reporting (CCDR) is the authoritative source of information associated with the Cost and Software Data Reporting (CSDR) system. CSDRs are the primary means by which the DoD collects data on the costs that contractors incur while working on DoD programs. CSDRs are the DoD's only systematic mechanism for capturing completed development and production contract costs, which provide more credible cost estimates for realistic budget estimates (DoD, n.d.a). The CRC would pull the CCDR information and relate the information to capabilities queried. This would provide amplifying information to stakeholders so that they could more accurately make decisions in acquisition programs and projects.

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